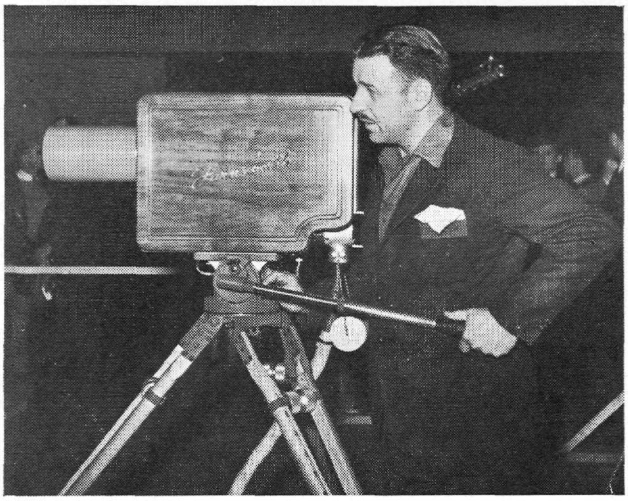
TELEVISION TOURS

By GORDON SHISLER

Photos Courtesy Farnsworth Television & Radio Corp.



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Fifteen years ago, a dream—today, a reality; that is the story of television, as we know it today. Now, at last, it has made its appearance in Columbus. Visitors to the new Lazarus service building, during the dedication week in November, were treated to a complete demonstration of transmission and reception of television signals. The demonstration, sponsored by Farnsworth Television and Radio Corp., was, as far as we know, the first public demonstration of its kind ever made in Columbus. Equipment used was a complete sending and receiving television system recently constructed by the company located in Fort Wayne, Indiana. The small, compact television unit, especially designed by Mr. Farnsworth and built for transportation in a standard size truck, is now making a nation-wide demonstration tour.

Arrangement of the demonstration consisted of a television camera and microphone, together with suitable lighting apparatus in one end of the room. In the opposite end was a compact transmitter with three receivers nearby. Visitors were able to see and hear the studio action as it was recreated instantaneously by the three receivers. The pictures produced by the unit were amazingly clear and well defined and the sensation of watching them was not unlike that of watching the common 8 millimeter home movie.

The system, as demonstrated, was comprised of the television camera for direct pickup of action scenes, a current supply board, and the three receivers cabled from the board. Thus, none of the signals were required to pass through the air, but were "piped" to the receivers much in the same way as modern radio stations are linked by telephone channels. This procedure required the use of short lengths of coaxial cable between the picture amplifier, located in the control board, and the receivers. The coaxial cable is used since ordinary telephone lines are not capable of transmitting the wide range of frequencies used in television transmission. Since the signals were simply amplified and cabled direct to the receivers, instead of being sent through the air, the demonstration was not affected by any atmospheric conditions. Under actual transmission conditions, in which the signals are sent through the air, the coaxial cable would be replaced by a high-frequency radio transmitter operating on a wave length of somewhere between five and seven meters.

Present Day Television Methods

The fundamental function of present day methods of television is, to change light waves into radio waves, use the radio waves to modulate an ordinary radio transmitter and finally, to receive the radio waves and change them back into light waves. Instead of changing sound waves into radio waves and broadcasting them, as is done in radio today, we simply substitute light waves for the sound waves. The sound waves accompanying the television picture can be considered simply as a separate radio wave accompanying the "picture" wave. The first step in the television process is infinitely more difficult than radio, which changes sound into electric waves. This is due to the fact that the picture has to be broken up into hundreds of thousands of picture elements. This process has its counterpart in photoengraving, which breaks pictures into myriads of very small dots. Each picture element, or dot, has to be registered, sent through the air as a radio vibration and picked up and placed on the receiving screen in its proper place with its proper amount of dark or white.

The changing of a picture element into a radio wave is accomplished by the television camera which, in the case of the Mobile Unit Camera, consists of a Farnsworth dissector tube and a one-stage radio amplifier. This tube is to television what the vacuum tube is to radio. It is a cylindrical vacuum tube shaped like an ordinary drinking cup. One end of the tube is coated with caesium, a radioactive substance which emits electronic vibrations in proportion to the amount of light striking it. The front end has a small periscope with an eye projecting down to the center of the tube. A lens, exactly like a camera lens, brings the picture to a focus on the caesium. The caesium then throws off electronic vibrations, giving the exact counterpart of the picture in electrons instead of light waves. This electronic picture is constantly being shifted by electric magnets, which surround the tube. This eye scans the picture in lines—441 lines to the picture, 30 pictures a second. This means that the magnets around the Farnsworth dissector tube have to pull the electronic picture back and forth, each time lowering or raising it slightly, 13,320 times a second. That this magnetic control must be exact is further demonstrated by the fact that the system is interlaced—that is, every other line is skipped, and then the electronic picture is pulled up by magnets, and hurled back and forth across the scanning eye again, filling in the other lines. The system really sends 60 half-pictures every second, but to the slow moving human eye, this makes the television pictures appear crystal sharp. The picture comes out the top end of the periscope unraveled, or dissected, into a continuous straight line of radio vibrations. The next step is to broadcast this one-line flow of radio vibrations, which is a comparatively simple problem.

The apparatus required to receive the signals employs a cathode ray tube which looks like a funnel with the viewing screen at the large end, and the place where the five million vibrations per second come in at the small end. This cathode ray is like a machine gun. As each vibration, or bullet, is received, it is shot against the viewing screen where it makes a dot of light, a bright dot if it is shot with great force, a darker one if it is shot with lesser force. And so the cathode sprays its dots of light and dark back and forth across the viewing screen 441 times a picture—30 pictures a second. The result is an exact duplicate of what the television camera has seen. This completes the third step of the television process. The sound which accompanies the picture simply goes along as another set of radio vibrations.

To have television in color it is necesrsary that other difficult problems be satisfactorily solved. Instead of just black and white with its five million vibrations a second, color pictures may require the sending of three separate pictures, each corresponding to one of the three primary colors, these pictures being superimposed at the receiver to provide a natural color television picture.

What Can We Expect in the Future?

The relation of the recent demonstration to the development of television transmission is of considerable importance. Modified forms of the equipment used in the demonstration are now being used in experimental

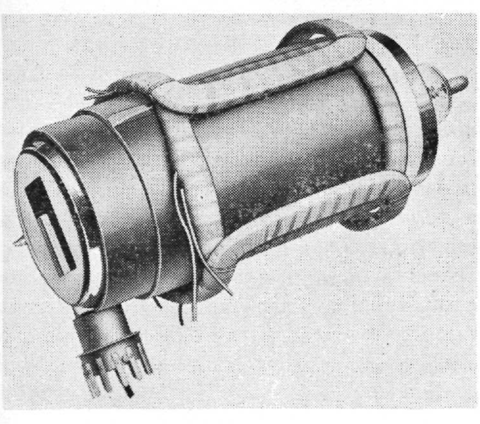
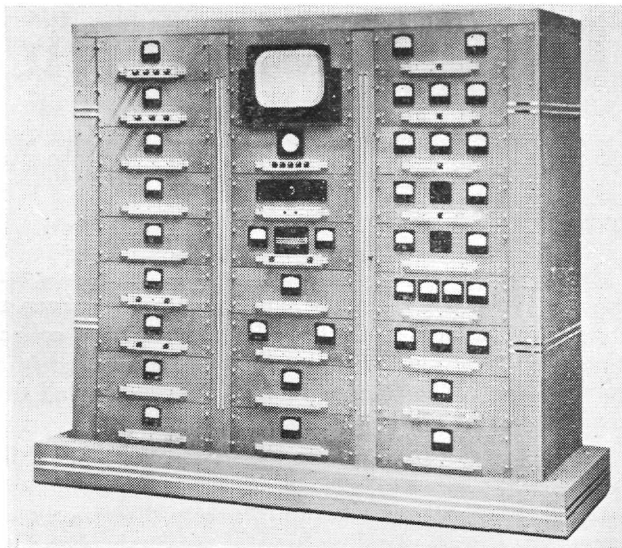


Image Dissector Tube



Control Board

pickups of news. Imagine, if you will, sitting in your home while watching the news as it happens! Such programs have actually been received in New York City where an experimental station is now in daily operation. The equipment used to pick up such scenes can easily be carried in large panel trucks. Although television has emerged from the research laboratory and today is an actuality, with receiving sets on the market and a few stations transmitting regularly, its growth to a position comparable with radio cannot come overnight. Leaders of the industry are confident there always will be two services—sound radio and sight radio, or television. The two services are regarded as supplementary, and authorities seem to be unanimous in the opinion that there are no indications television will replace sound radio service. One of the knotty problems is that television, unlike radio, cannot use ordinary telephone or telegraph wires to arrange station-to-station hookups. In an effort to conquer the problem of commmercial transmission of pictures, engineers have developed the coaxial cable. The only coaxial line now in this country is between New York and Philadelphia. In its present state of devolopment it is too costly for wide application. Engineers, however, are developing a system of automatic radio relay stations that would pick up a program at regular intervals and relay it without the use of wire. Television must send around five million vibrations a second, and this has forced television broadcasting down into the very short wave lengths. One television station sending on an ordinary radio station wave length would absorb the wave lengths of every other broadcasting station in the United States. The short waves assigned to television do not follow the curvature of the earth. Unlike the long radio waves, the short ones flow only in the visual plane and, generally speaking, if the receiver is more than 60 miles away from the sending station, the program cannot be picked up. This problem of providing wide coverage through station networks is receiving the attention of engineers, and continued research and experiment are confidently expected by scientists to yield an economical solution.